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Impact of Boundary Layer Suction on the Prediction of Drag and Transition for Transport Aircraft with Hybrid Laminar Flow Control

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Abstract

Keywords: *Hybrid Laminar Flow Control (HLFC), boundary layer suction, drag prediction*

Hybrid laminar flow control (HLFC) promises significant drag savings for long range transport aircraft [1, 2]. With regard to an industrial application of HLFC technology, reliable and consistent simulation methods are required. In this paper, recent extensions of DLRs RANS solver TAU towards HLFC simulation capability are described. The extensions comprise a suction boundary condition for the TAU code and treatment of prescribed suction distributions by the boundary layer solver as part of the coupled transition prediction method [3].

A key objective was to study the effects of active boundary layer suction in the RANS solver w.r.t. drag, boundary layer development and predicted transition locations. Results obtained with the active boundary layer suction BC show a significant increase of local skin friction due to suction, compared to the case without suction. The small suction rates required for stabilization of the laminar boundary layer lead to almost no thinning of the boundary layer thickness. Therefore the reduction in viscous pressure drag due to suction is small and the pressure distribution is widely unaffected. The new simulation capabilities allow for an improved drag prediction for HLFC configurations.

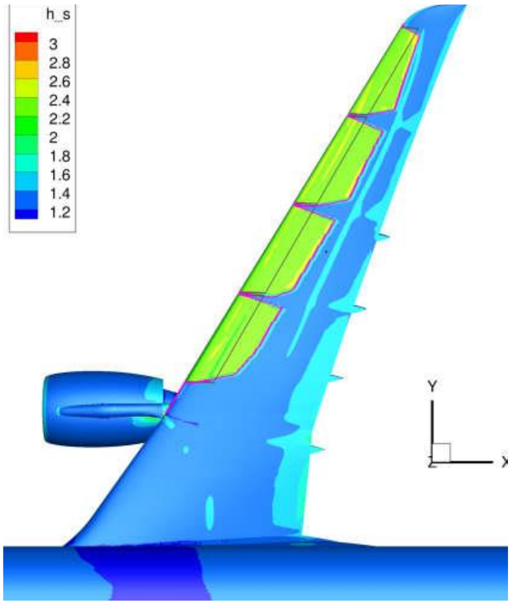

Fig. 1: Shape factor H12 with active suction

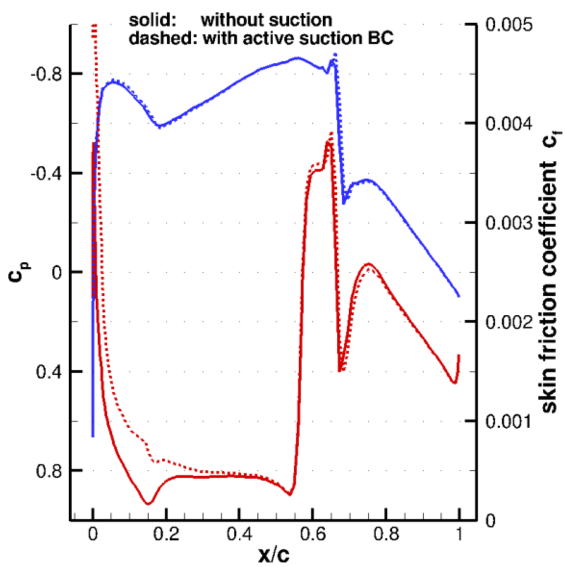

Fig. 2: Impact of BL suction on skin friction and pressure distribution

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